tanical Gazette, concludes that the Californian willow, *Salix Coulteri* Anders. is "nearly allied to—if not identical with"—*S. sitchensis* Sanson, which, like *S. Coulteri*, he now finds to have but *one stamen under each scale!* *S. Coulteri* he regards as probably nothing more than "an extravagant autumnal growth of *S. sitchensis*."——In the same journal Dr. Farlow notices the injury to the vine in Europe and Algiers caused by the American grape mildew (*Peronospora viticola* B. & C.). In moist regions it appears to be very injurious, even approaching the *Phylloxera* in some cases. Lime, antiseptic fluids, and other applications, failed to check the parasitic growths. Burning the leaves to destroy the oöspores is recommended.——Dr. R. E. Kunzé's paper on "The Germination and Vitality of Seeds," read before the Torrey Botanical Club, contains a mass of valuable information collected from many sources. Copies may be obtained of N. L. Britton, School of Mines, New York city, for fifty cents each.——Among the valuable foreign botanical journals, which American students may profitably consult, the *Archives Botaniques du Nord de la France*, must be mentioned. Lotar's memoir on the comparative anatomy of the vegetative organs of the Cucurbitaceæ is well worth careful reading.——Dr. W. P. Wilson has published a paper on "The Cause of the Excretion of Water on the Surface of Nectaries," in which he shows it to be due not to internal pressure, as has generally been assumed, but to osmotic action. ——Dr. W. A. Kellerman's paper, *Entwickelungsgeschichte der Blüthe von Gunnera chilensis Lam.*, is a valuable contribution to our knowledge of these curious plants. Four plates accompany the paper.

ZOÖLOGY.

THE NATURE OF LIFE.—This is a tempting problem; it has attracted the attention of the thoughtful of the past, and is attracting the attention of the thoughtful of the present, yet in spite of untiring efforts, in spite of ingenious arguments, it is still unsolved. Is it insolvable? This again is a question not to be answered hastily, either in the negative or the affirmative, since so much that was once thought insolvable has been solved; while so much that was supposed to be solved (by revelation or authority) has proved to be still unknown. As indices which *may* point towards a solution, we give a short abstract of three papers that have lately appeared.

D. Monnier and C. Vogt (*Comptes Rendus*, Jan. 12, 1882) state that by the joint action of two salts forming by double decomposition one or two insoluble salts, are produced cellules, tubes and other forms assumed by organic life. The liquid in which this takes place may be of organic or semi-organic nature, or absolutely inorganic, but one of the salts must be dissolved in the liquid, while the other is present in a solid form. Saccharate of

lime and silicate of soda are among the liquids in which these pseudo-organic forms can be produced; certain viscid liquids yield no such results; the form of pseudo-organic product is constant with the same salts; and with some exceptions, the forms are only obtained from substances which are found in real organisms. Sulphates and phosphates produce tubes, carbonates give rise to cellules. Membraneous cell-wall, giving passage only to liquids; and heterogenous granular contents combine to render the resemblance to forms organically produced, most striking. M. Fournier obtained similar results as early as 1878.

Messrs. O. Loew and T. Bokorny, of Munich, have worked the idea advanced by Professor Pflüger, that there is a chemical distinction between living and dead protoplasm, up to a tangible hypothesis. Herr Loew found that albumen contained a number of aldehyde-groups closely bordering on amide-groups. Such groups, according to modern chemistry, must have intense atomic motion, and Herr Loew argued that this motion constitutes life. It was found that living protoplasm had the power of reducing silver from a very dilute alkaline solution, whilst dead protoplasm lacked this power. Their theory is that the aldehyde-groups of each molecule are brought into immediate proximity with the amide-groups of the next, thus causing intensification of molecular action; with increased complexity and mobility follows increased instability, and thus apparently trifling agencies displace the molecules, cause their action to cease, and liberate heat, producing fevers, etc. When lifeless albumen is converted into the protoplasm of a living cell, heat becomes latent. Vital force, in the opinion of these chemists, is due to the tension of the aldehyde-groups ultimately due to electric differences, and life is the total result yielded.

The reviewer in the *Journal of Science* points out that Loew and Bokorny appear to regard albumen and protoplasm as identical, whereas, according to the analyses of Reinke, protoplasm contains scarcely thirty per cent. of albuminous matter, and includes upwards of forty proximate principles. The third contribution to the subject is that of O. Bütschli, who in *Zoologischer Anzeiger* publishes some original thoughts of life and death. He first draws attention to the great difference between the nature of death in the Protozoa and Metazoa. In the former the parent never exists by the side of its offspring, its reproduction (by fission or spore-formation is the death of the individual. The higher animals, on the other hand, live after the birth of their offspring, but for a certain limited time, and their death throws a quantity of organic matter into inactivity. He then finds the hypothetical cause of the limited duration of individual life in the nature of the egg, which he supposes to endow the individual with a limited quantity of a "in a certain sense ferment-like working substance" *(in gewissem Sinne fermentartig wirkenden Stoffes)*. This limited

quantity diminishes perpetually in energy, and is finally exhausted, producing the death of the individual. Meanwhile, certain tracts are set aside as reproductive organs, and produce a fresh supply of this "life-ferment" for the continuance of the species. The rejuvenescence of the nucleus of the infusoria by conjugation is homologized with that of the egg by the spermatozoa, but while the nucleoli of the infusoria are principally concerned in the process of rejuvenescence, the cells which bring about development in the metazoa proceed chiefly from the nucleus of the male sexual cells.

This is at least an ingenious hypothesis, but lacks support from observation. We know of no "life-ferment," and protoplasm the only life-substance we know of is certainly produced in plants, while animals contain more than they derived from the egg.

Is Man the Highest Animal?[1]—The measure of zoölogical rank is the specialization exhibited by all the organs, taken collectively. Specialization may be exaggerated in one or several organs, without the animal therefore attaining as a whole a high rank. This is the case in man. The measure of specialization is afforded by embryology, which shows in earlier stages the simplicity and uniformity of structure, which in later stages is replaced by complexity. The human body preserves several important embryonic features. In man we find three series of high differentiations, namely: in the brain, in the changes induced by or accompanying the upright position, and third in the opposibility of the thumbs to the other digits. These are the principal, though of course not strictly the only characteristics of man, which show that he is more specialized than any other animal. In other respects he shows a still more striking inferiority. It is of course a familiar observation that his senses are less acute than those of many animals—he has neither the keen vision of the falcon, nor the delicate scent of the dog. He is equally inferior in many structural features. His teeth are of a low mammalian type, as is shown both by his dental formula, and by the presence of cusps upon the crowns of the teeth, a peculiarity of the lower mammalia, entirely lost in the horse, the elephant, and many other "brutes." His limbs show a similar inferiority since they are little modified, preserving even the full number of five digits, and in respect of these members man stands therefore very low, lower than the cow and the pig. He plants the whole sole of his foot upon the ground, yet none except the lower mammalia, together with man and his immediate congeners are plantigrade. So too with his stomach, which is so simple as compared with that of a ruminant, and indeed is of about the same grade as that of the carnivora. It makes, however, a still more forcible impression to

[1] Read before the American Association for the Advancement of Science, Cincinnati meeting, August, 1881.

learn that the human face, which we admire when withdrawn under a high intellectual forehead, is perhaps the most remarkable of all the indices that point out man's inferiority. In the mammalian embryo the face is formed under the fore brain or cerebral hemispheres. In our faces the fœtal disposition is permanently retained, with changes, which when greatest are still inconsiderable. In quadrupeds the facial region acquires a prominent development leading to the specialization of the jaws and surrounding parts, which brings the face to a condition much higher than that of the fœtus. Hence the projecting snout is a higher structure than the retreating human face. These facts have long been familiar to anatomists, but I am not aware that the inferiority of the human to the brute countenance has heretofore been considered a scientific conclusion by any one. Yet that inferiority is incontrovertible and almost self-evident.

The preceding statements render it clear to the reason, that man is not in all respects the highest animal—and that it is a prejudice of ignorance, that assumes that the specialization of the brain marks man as above all animals in the zoölogical system. It does give him a supremacy by his greater power of self-maintenance in the struggle of the world, but that has nothing whatsoever to do with his morphological rank. There is nothing in morphology that anywise justifies assigning, as is actually done, an almost infinitely greater systematic value to the specialization of the brain and a specialization of the limbs, stomach, teeth, face, etc., hence it is impossible to call man even the highest mammal. It is also doubtful whether mammals would be regarded as the highest class of the animal kingdom, were they not our nearest relatives. Let us beware of claiming to be the head of organic creation, since the Carnivora and Ungulata are in many respects higher than we. I believe that it is just as unscientific to call any one animal species the highest, as to pitch upon any one plant to stand at the head of the vegetable kingdom.—*C. S. Minot.*

Zoological Notes.—Mr. Chas. Linden, in a paper in the Bulletin of the Buffalo Society of Natural Sciences, states that the wood duck is easily domesticated, Mr. Irvin having raised successive broods of that species for many years, amounting frequently to thirty or more full-fledged young in one season. All the various ducks he experimented with migrated southward each autumn, and infallibly returned with a male mate, which remained until the young began to hatch. The observations recorded indicate that the majority of our wild ducks do not easily change their wild condition, but yet manifest no aversion to breeding freely when placed under artificial restraint.——Mr. Fewkes has described in the *American Journal of Science* for February, a Cercaria $\frac{1}{16}$ inch long, found swimming with a jerky motion by means of a long tail, which at intervals has bundles of long setæ arranged on opposite sides like those of an annelid. Mr. Fewkes in stating that in the possession

of regular paired bundles of bristles, this Cercaria differs from all others known, has apparently overlooked the work of Valette St. George, wherein he figures *Cercaria setifera* Müll. and *C. elegans* Müll., both inhabiting the Mediterranean sea. The tails are provided with bundles of setæ in pairs, and are much as in Mr. Fewkes species.——In his tenth census report on the Oyster Fishery, Mr. E. Ingersoll describes the way in which the star-fish gains entrance to the oyster shell in order to feed upon it. Having met with an oyster, scallop, or other thin-shelled mollusk, and young ones are preferred because their armor is weak, the star-fish folds his five arms about it in a firm and deadly grasp. Then protruding the muscular ring at the entrance of his stomach through the circular opening in the centre of the under side of the disc, which he previously describes, he seizes the thin, newly-grown posterior edge of the shell, which oystermen call the "nib" or "bill," and little by little breaks it off. Then the star-fish protrudes into the shell the distensible mouth of the stomach, until it can seize upon the body of the mollusk. "The consumption of this begins at once, and as fast as the poor oyster's or scallop's body is drawn within its folds, the capacious stomach is pushed farther and farther in, until at last if the mollusk be a large one, the pouches that I have described as packed away in the cavities of the ray, are also drawn forth, and the starfish has substantially turned himself wrong side out. If he is dredged up at this stage as many examples constantly happen to be, and dragged away from his half-eaten prey, his stomach will be found hanging out of the centre of his body for a distance, perhaps, equal to half the length of one of the arms, and filled with the juices of the oyster he has devoured, and whose body, within the shell, will be found almost as squarely trimmed as could have been done by scissors." The wholesale manner in which the star-fish invades oyster beds, and the great increase in numbers of this creature since oyster beds have been planted are described. The injury done to oyster beds by the star-fish from Buzzard's bay to the western end of Long Island sound is estimated at $200,000 a year.

ENTOMOLOGY.[1]

NOTES FROM ILLINOIS; GRAIN-FEEDING HABITS OF FIELD CRICKET.—One morning after a rainy night, as I was passing along the highway, I noticed one of our common field crickets working at a kernel of corn that had dropped from some farmer's wagon while on the way to market. The rain had softened the grain; and after watching the insect some time, I found it was eating the germ of the softened kernel; I watched patiently until the cricket seemed to have satisfied its hunger, and found the germ had all

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.